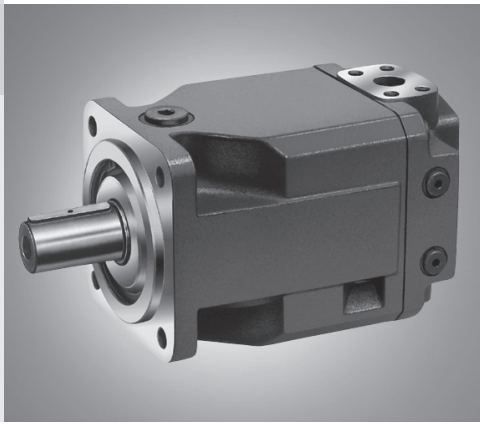
Rexroth
Bosch Group

Fixed Displacement Motor A4FM

RE 91 120/04.00
replaces: 03.95
and RE 91 100

for open and closed circuits



Sizes 22...500
Series 1, Series 3
Nominal pressure up to 400 bar
Peak pressure up to 450 bar

Index

Features

- Axial Piston Fixed Displacement Motor A4FM of swashplate design is used in open and closed loop circuits for hydrostatic drives.
- Output speed is proportional to input flow and inversely proportional to motor displacement.
- Output torque increases with the pressure drop across the motor between the high and low pressure sides.
- Long service life, optimum efficiencies
- Compact design for special applications where A2FM cannot be applied
- Proven rotary group in swashplate-technology

Ordering Code

	A4F	M		/			W	–				

Hydraulic fluid

Mineral oil, HFD (no code)	
HFA, HFB, HFC-Hydraulic fluid (only sizes 71...500)	**E-**

Axial piston unit

Swashplate design, fixed displacement	**A4F**

Mode of operation

Motor	**M**

Size

≙ Displacement V_g (cm^3)	**22**	**28**	**40**	**56**	**71**	**125**	**250**	**500**
	●	●	●	●	●	●	●	○

Series

Sizes 22...56, 125...500	**3**
Size 71	**1**

Index

Sizes 22...56	**2**
Sizes 71...500	**0**

Direction of rotation

Viewed on shaft end	alternating	**W**

Seals

NBR (Nitril-caoutchouc), shaft sealing in FKM (Fluor-caoutchouc)	Sizes 22...56	**N**
	Sizes 71...500	**P**
FKM (Fluor-caoutchouc)	Sizes 71...500	**V**

Shaft end	**22**	**28**	**40**	**56**	**71**	**125**	**250**	**500**	
Splined shaft SAE	○	○	–	–	–	–	–	–	**S**
Splined shaft SAE	●	●	–	–	–	–	–	–	**T**
Splined shaft DIN 5480	–	–	●	●	●	●	●	○	**Z**
Parallel with key DIN 6885	–	–	–	–	●	●	●	○	**P**

Mounting flange	**22**	**28**	**40**	**56**	**71**	**125**	**250**	**500**	
SAE 2-hole	●	●	●	●	–	–	–	–	**C**
ISO 4-hole	–	–	–	–	●	●	●	–	**B**
ISO 8-hole	–	–	–	–	–	–	–	○	**H**

Service line connections	**22...40**	**56**	**71...500**	
Ports A, B: SAE at rear (with metric fixing screws)	–	●	●	**01**
Ports A, B: SAE at side (on opposite sides) (with metric fixing screws)	●	–	●	**02**

● = available
○ = available on enquiry
– = not available

Technical Data

Fluid

We request that before starting a project detailed information about the choice of pressure fluids and application conditions are taken from our catalogue sheets RE 90220 (mineral oil), RE 90221 (environmentally acceptable hydraulic fluids) and RE 90223 (fire resistance fluids, HF).

When using HF- or environmentally acceptable hydraulic fluids possible limitations for the technical data have to be taken into consideration. If necessary please consult our technical department (please indicate type of the hydraulic fluid used for your application on the order sheet).

The sizes 22..56 are not suitable for operation with HFA, HFB and HFC.

Operation viscosity range

In order to obtain optimum efficiency and service life, we recommend that the operating viscosity (at operating temperature) be selected from within the range:

ν_{opt} = operating viscosity 16...36 mm²/s

referred to the loop temperature (closed circuit) or tank temperature (open circuit).

Viscosity limits

The limiting values for viscosity are as follows:

Size 22...56

ν_{min} = 5 mm²/s, short term at a max. permissible temp. of t_{max}= 115°C

ν_{max} = 1600 mm²/s, short term on cold start (t_{min} = -40°C)

Size 71...500

ν_{min} = 10 mm²/s, short term at a max. permissible drain temp. t_{max} = 90°C

ν_{max} = 1000 mm²/s, short term on cold start (t_{min} = -25°C)

Please note that the max. fluid temperature is also not exceeded in certain areas (for instance bearing area).

At temperature of -25°C up to -40°C special measures may be required for certain installation positions, please contact us.

Notes on the selection of the hydraulic fluid

In order to select the correct fluid, it is necessary to know the operating temperature in the loop (closed circuit) or the tank temperature (open circuit) in relation to the ambient temperature.

The hydraulic fluid should be selected so that within the operating temperature range, the operating viscosity lies within the optimum range (ν_{opt}) (see shaded section of the selection diagram). We recommend that the highest possible viscosity range should be chosen in each case.

Example: At an ambient temperature of X°C the operating temperature is 60°C. Within the operating viscosity range (ν_{opt}; shaded area), this corresponds to viscosity ranges VG 46 or VG 68. VG 68 should be selected.

Important: The leakage oil (case drain oil) temperature is influenced by pressure and motor speed and is always higher than the circuit temperature. However, at no point in the circuit may the temperature exceed 115°C for sizes 22...56 or 90°C for sizes 71...500.

If it is not possible to comply with the above condition because of extreme operating parameters or high ambient temperatures we recommend housing flushing. Please consult us.

Filtration

The finer the filtration the better the achieved purity grade of the pressure fluid and the longer the life of the axial piston unit. To ensure the functioning of the axial piston unit a minimum purity grade of:

9 to NAS 1638

18/15 to ISO/DIS 4406 is necessary.

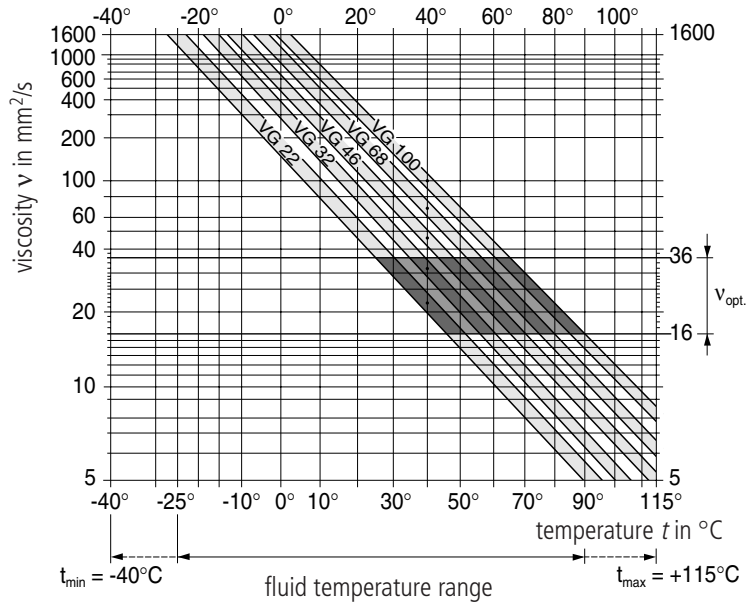
At very high temperatures of the hydraulic fluid (90°C to max. 115°C, not permissible for sizes 71...500) at least cleanless class

8 to NAS 1638

17/14 to ISO/DIS 4406 is necessary.

If above mentioned grades cannot be maintained please consult supplier.

Selection diagram



Technical Data

valid for operation with mineral oils

Flushing of the bearings (Sizes 125...500)

operating conditions, flushing quantities and notes on bearing flushing see RE 92 050 (A4VSO).

Operating pressure range

Maximum pressure at port A or B (Pressure data to DIN 24312)

Size		22...56	71...500
Nominal pressure p_N	*bar*	400 [1])	350
Peak pressure p_{max}	*bar*	450 [1])	400

[1]) Size 28 with S-shaft: 315/350 bar

The summ of the pressures at ports A and B may not exceed 700 bar.

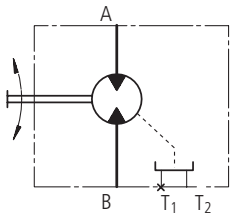
Direction of flow

clockwise rotation	anti-clockwise rotation
A to **B**	**B** to **A**

Symbol

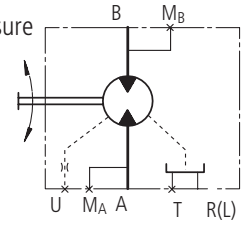
Size 22...56

A, B Service line ports
T_1, T_2 Case drain (1 port plugged)



Size 71...500

A, B Service line ports
M_A,M_B Pressure gauge, working pressure
T, R(L) Case drain, Air bleed (1port plugged)
U Flushing port (Sizes71...500)



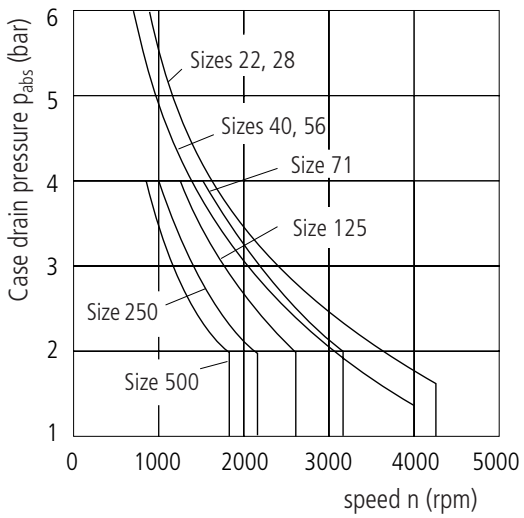
Case drain pressure

The max. permissible leakage pressure (housing pressure) is dependent on speed (see diagram). The pressure in the housing must be equal to or greater than the external pressure on the shaft sealing ring.

Max. leakage pressure (housing pressure)

$p_{abs.\ max.}$ _____ 6 bar (sizes 22...56)
_____ 4 bar(sizes71...500)

A leakage line to the tank is necessary.



Installation and Commissioning Guidelines

General

At start-up and during operation the motor housing has imperatively to be filled up with hydraulic fluid (filling of the case chamber). Start-up has to be carried out at low speed and without load till the system is completely bleeded.

At a longer standstill the case may discharge via operating line. At new start-up a sufficient filling of the housing has to be granted.

The leakage oil in the housing has to be discharged to the tank via highest positioned case drain port.

Installation position

- Sizes 22...56: Shaft horizontal or shaft down
- Sizes 71 (series1): Shaft horizontal, vertical installation position as to agreement
- Sizes 125...500: Optional, at vertical installation position bearing flushing is recommended at port U (as to RD 9205)

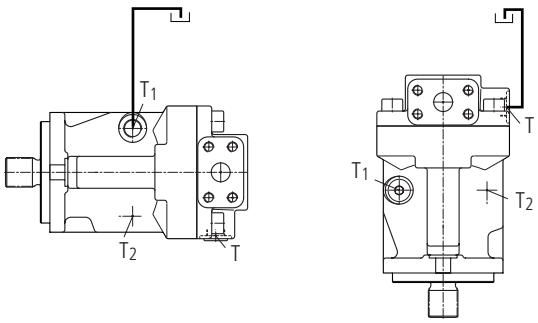
Installation below tank level

Motor below min. oil level in the tank (standard)

➔ Fill up axial piston motor before start-up via highest positioned case drain port

➔ Operate motor at low speed till motor system is completely filled up

➔ Minimum immerson depth of the drain line in the tank: 200mm (relative to the min. oil level in the tank).

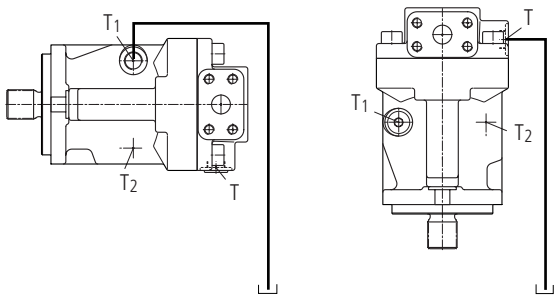


Installation on top of tank level

Motor on top of min. oil level in the tank

➔ Actions as installation below tank level

➔ Note: installation position "drive shaft up" for sizes 22...56 not permissible



Technical Data

valid for operation with mineral oil

Table of values (theoretical values, without considering η_{mh} and η_v; values rounded)

Size			22	28	40	56	71	125	250	500
Displacement	V_g	cm^3	22	28	40	56	71	125	250	500
Max. speed	$n_{max\ continuous}$	rpm	4250	4250	4000	3600	3200	2600	2200	1800
	$n_{max\ interm.}$ [1])	rpm	5000	5000	5000	4500	–	–	–	–
Max. flow (at n_{max})	$q_{V\ max}$	L/min	93	119	160	202	227	325	550	900
Torque constants	T_K	Nm/bar	0,35	0,445	0,64	0,89	1,13	1,99	3,97	7,95
Torque (at Δp = 400 bar)	T_{max}	Nm	140	178	255	356	395[2])	696[2])	1391[2])	2783[2])
Filling volume		L	0,3	0,3	0,4	0,5	2,0	3,0	7,0	11,0
Moment of inertia about drive axis	J	kgm^2	0,0015	0,0015	0,0043	0,0085	0,0121	0,0300	0,0959	0,3325
Actual starting torque at n = 0 rpm (Δp = 350 bar)		Nm (approx.)					320	564	1127	
Weight (approx.)	m	kg	11	11	15	21	34	61	120	

[1]) Intermittent max. speed at overspeed: Δp = 70…150 bar [2]) Δp = 350 bar

Calculation of size

Flow $q_v = \frac{V_g \bullet n}{1000 \bullet \eta_v}$ in L/min

Output speed $n = \frac{q_V \bullet 1000 \bullet \eta_v}{V_g}$

Output torque $T = \frac{V_g \bullet \Delta p \bullet \eta_{mh}}{20 \bullet \pi}$ in Nm

$= T_K \bullet \Delta p \bullet \eta_{mh}$

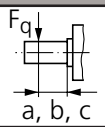
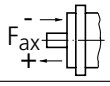
Output power $P = \frac{T \bullet n}{9549} = \frac{2\pi \bullet T \bullet n}{60\,000}$ in kW

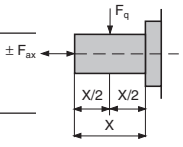
$= \frac{q_v \bullet \Delta p \bullet \eta_t}{600}$

V_g = geometric displacement per rev. in cm^3
Δp = pressure differential in bar
n = speed in rpm
η_v = volumetric efficiency
η_{mh} = mech.-hyd. efficiency
η_t = overall efficiency

Output drive

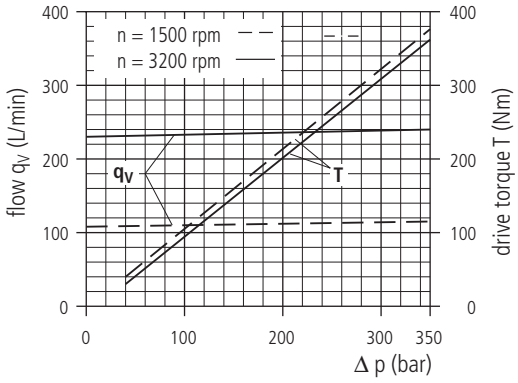
permissible axial and radial loading on drive shaft

Size				22	28	40	56
Distance of F_q (from shaft shoulder) 	a	mm		17,5	17,5	17,5	17,5
	b	mm		30	30	30	30
	c	mm		42,5	42,5	42,5	42,5
Max. permissible radial force at distance	a	$F_{q\ max}$	N	2500	2050	3600	5000
	b	$F_{q\ max}$	N	1400	1150	2890	4046
	c	$F_{q\ max}$	N	1000	830	2416	3398
Max. permissible axial load 		- $F_{ax\ max}$	N	1557	1557	2120	2910
		+ $F_{ax\ max}$	N	417	417	880	1490

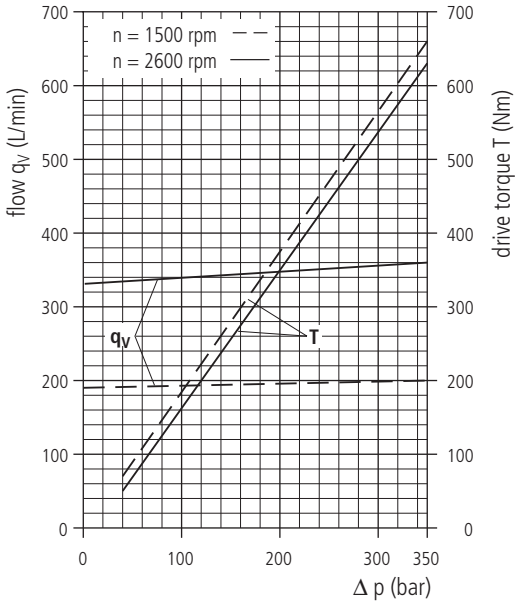
Size				71	125	250	500
Max. axial force at housing pressure p_{max} 1 bar abs. 	± $F_{ax\ max}$	N		1400	1900	3000	4000
Max. axial force at housing pressure p_{max} 4 bar abs.	+ $F_{ax\ max}$	N		810	1050	1850	2500
	– $F_{ax\ max}$	N		1990	2750	4150	5500
Max. radial force	$F_{q\ max}$	N		1700	2500	4000	5000

Flow and Drive Torque

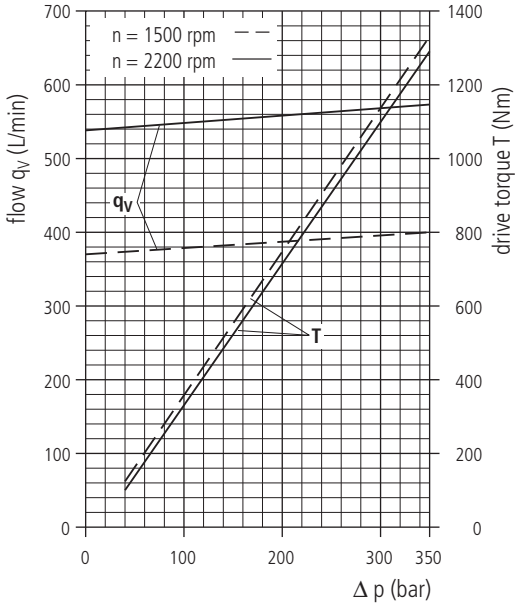
Size 71



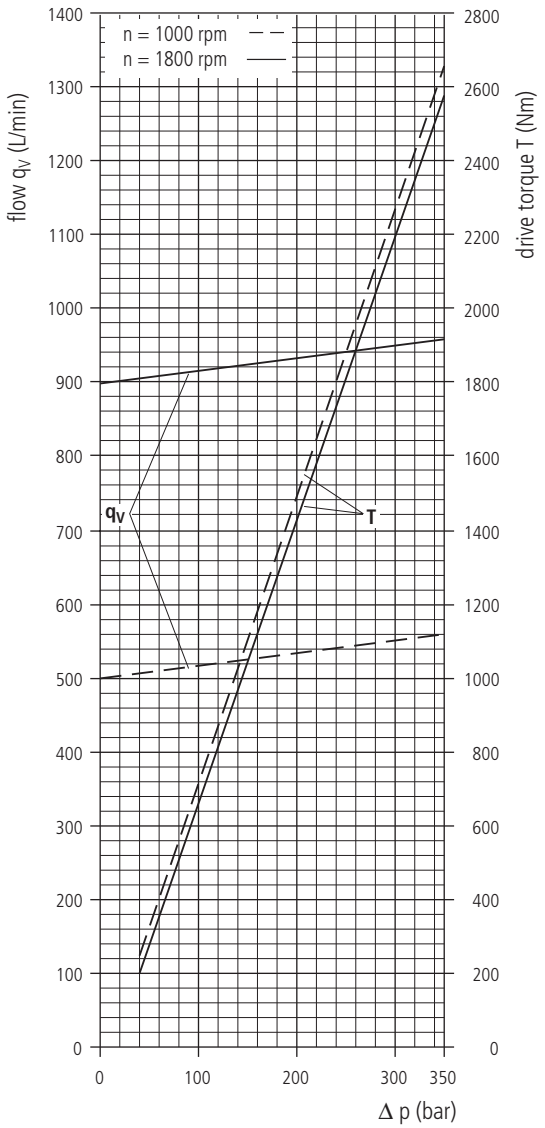
Size 125



Size 250



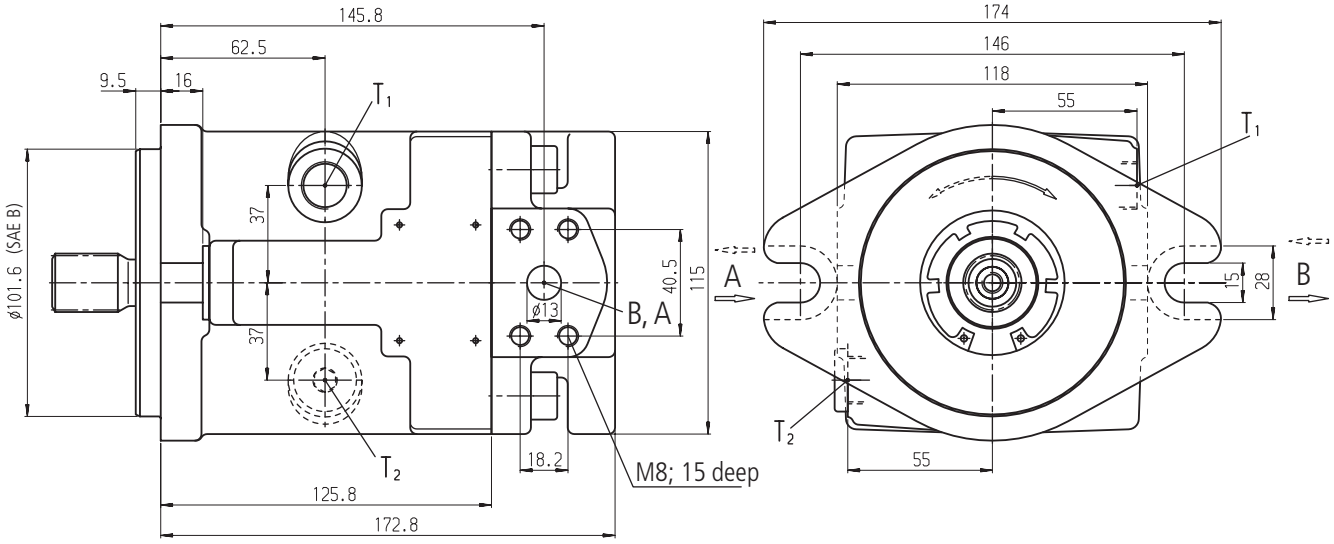
Size 500



(Fluid: Hydraulic oil ISO VG 46 DIN 51519, t = 50°C)

Unit Dimensions, Size 22, 28

Before finalising your design, please request a certified drawing.



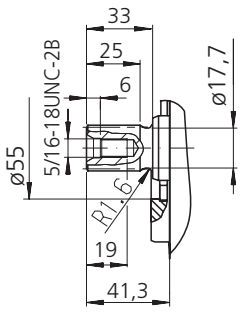
Connections

A, B	Service line ports	SAE $^1/_2$" 420 bar (6000 psi) high pressure series
T_1, T_2	Leakage port / oil filling port	M18x1,5; 12 deep

Shaft ends

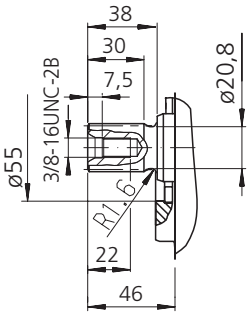
S

Splined shaft SAE $^7/_8$",
30° pressure angle,
13 teeth, 16/32 pitch,
flat root, side fit,
tolerance class 5
ANSI B92.1a-1976



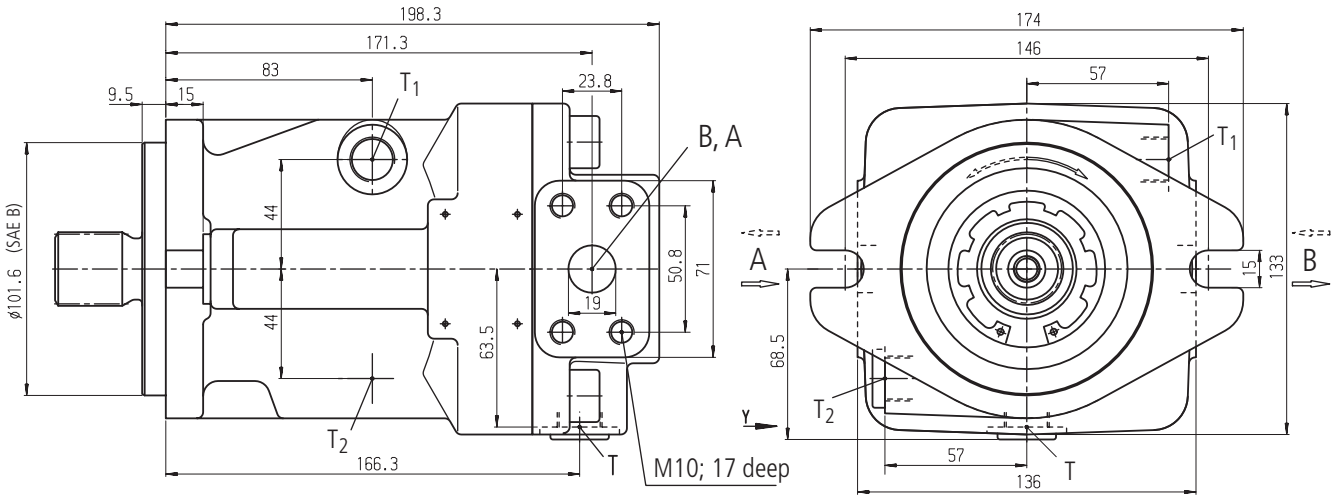
T

Splined shaft SAE 1"
30° pressure angle,
15 teeth, 16/32 pitch,
flat root, side fit,
tolerance class 5
ANSI B92.1a-1976



Unit Dimensions, Size 40

Before finalising your design, please request a certified drawing.



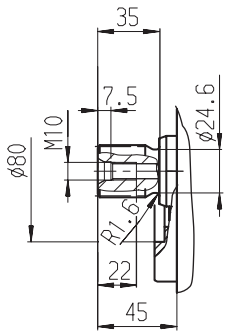
Connections

A, B	Service line ports	SAE $^3/_4$" 420 bar (6000 psi) high pressure serie
T, T_1, T_2	Leakage port / oil filling port	M18x1,5; 15 deep

Shaft ends

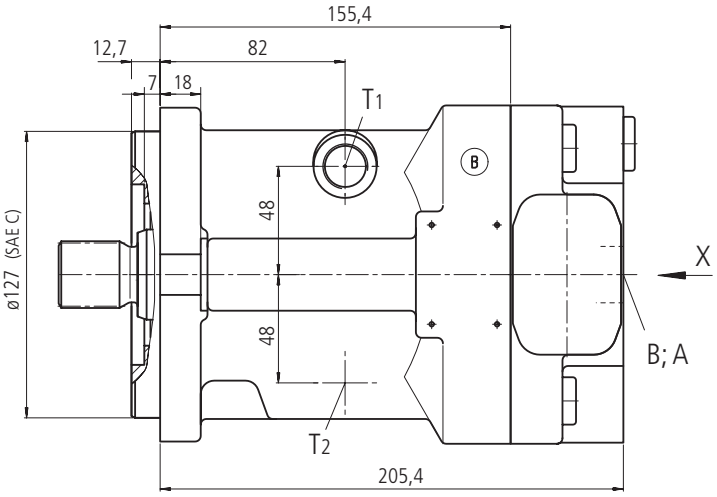
Z

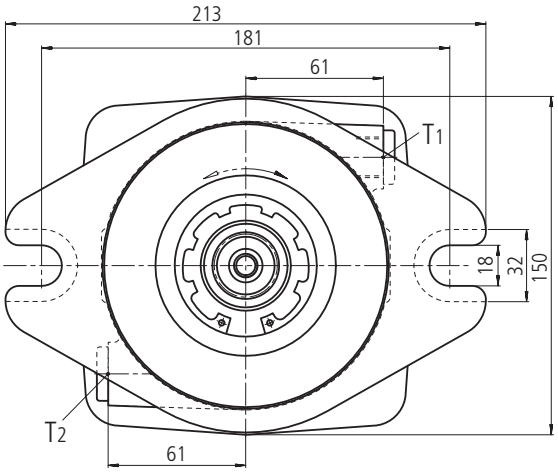
Splined shaft
W 30x2x30x14x9g
DIN 5480



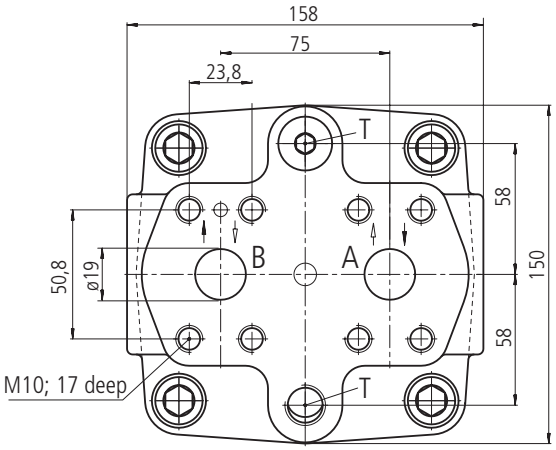
Unit Dimensions, Size 56

Before finalising your design, please request a certified drawing.





View X



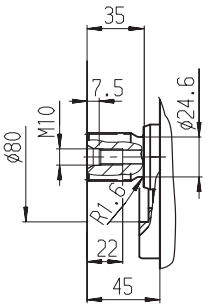
Connections

A, B	Service line ports	SAE $^3/_4$" 420 bar (6000 psi) high pressure serie
T, T_1, T_2	Leakage port / oil filling port	M 18x1,5 ; 12 deep

Shaft ends

Z

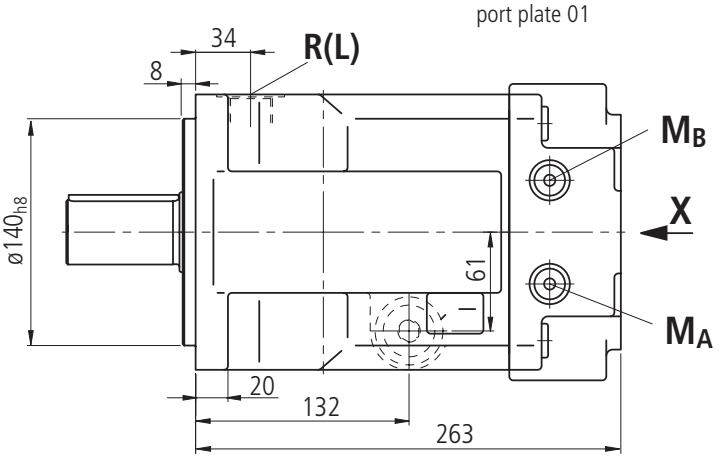
Splined shaft
W 30x2x30x14x9g
DIN 5480

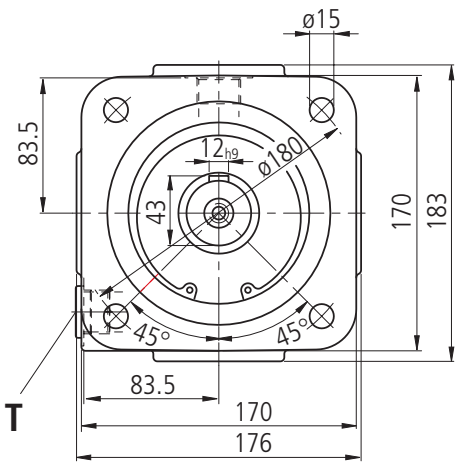


Unit Dimensions, Size 71

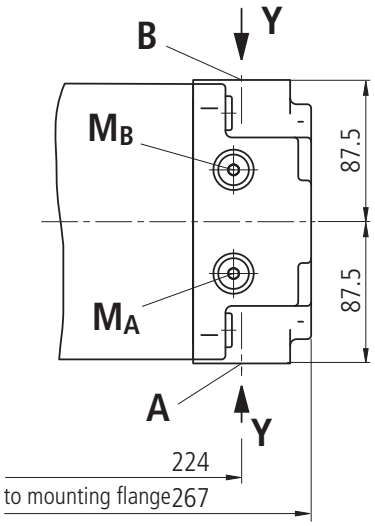
Before finalising your design, please request a certified drawing.

port plate 01

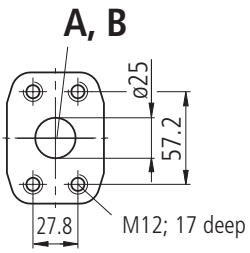




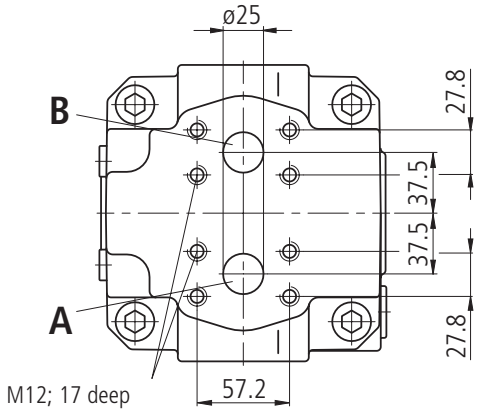
port plate 02



View Y



port plate 01
View X



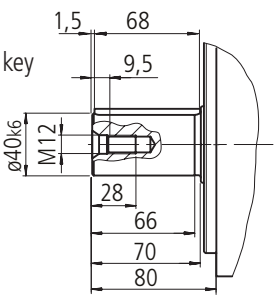
Connections

A, B	service line ports	SAE 1" (high pressure series)
R (L)	oil filling and bleed	M27x2
T	oil drain (plugged)	M27x2
M_A, M_B	measuring port for pressure (plugged)	M14x1,5

Shaft end

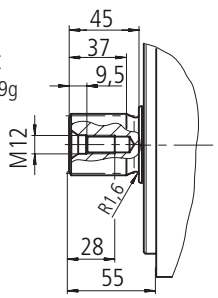
P

Parallel shaft with key
AS 12x8x68
DIN 6885



Z

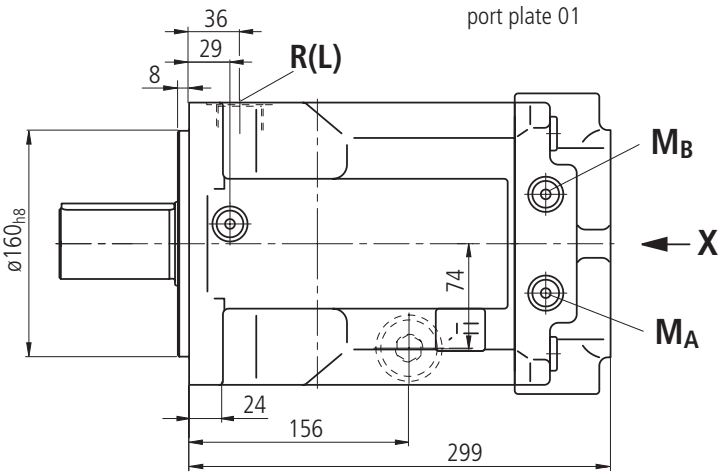
Splined shaft
W40x2x30x18x9g
DIN 5480

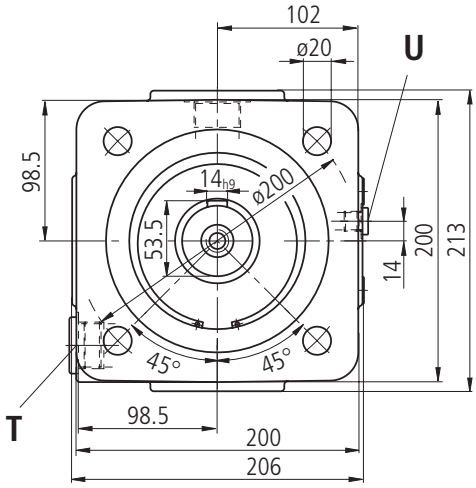


Unit Dimensions, Size 125

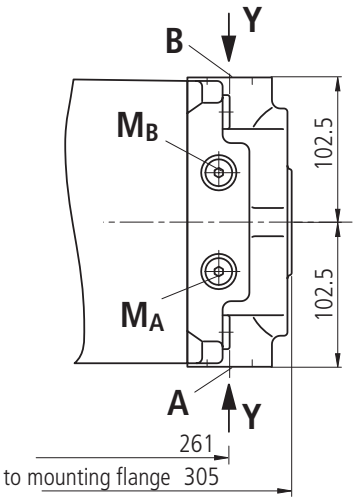
Before finalising your design, please request a certified drawing.

port plate 01

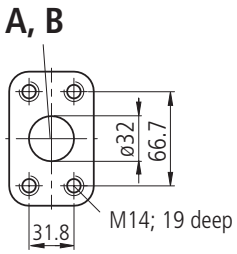




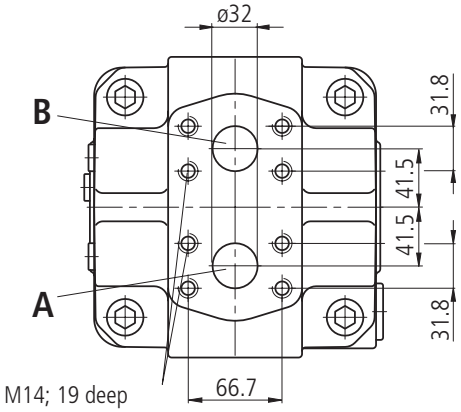
port plate 02



View Y



port plate 01
View X



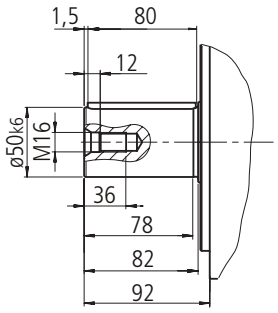
Connections

A, B	service line ports	SAE 1 1/4" (high pressure series)
R (L)	oil filling and bleed	M33x2
T	oil drain (plugged)	M33x2
M_A, M_B	measuring port for pressure (plugged)	M14x1,5
U	Flushing port, flushing of the bearings (plugged)	M14x1,5

Shaft end

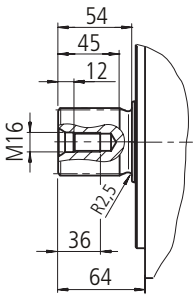
P

Parallel shaft with key
14x9x80
DIN 6885



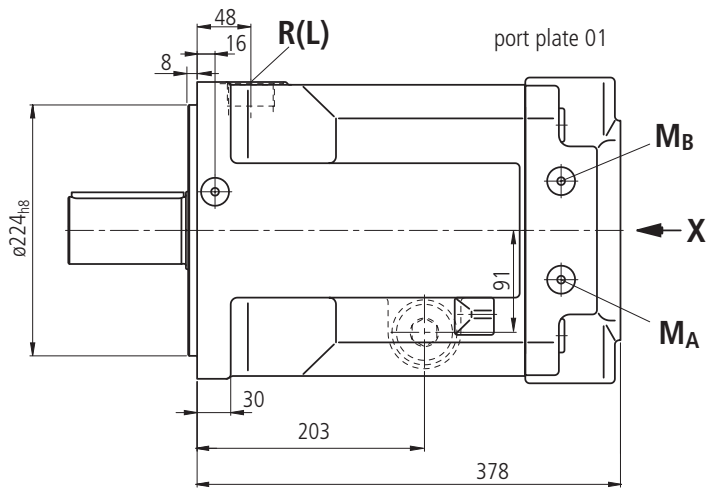
Z

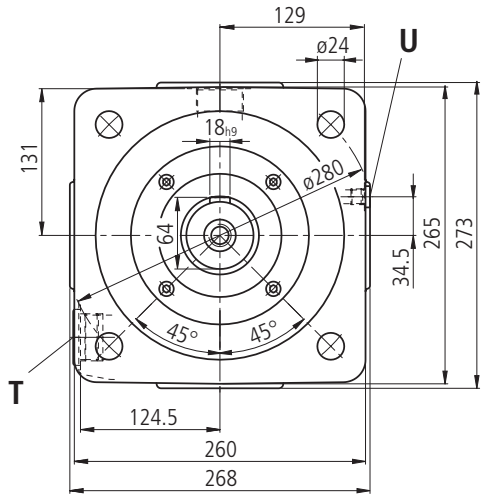
Splined shaft
W50x2x30x24x9g
DIN 5480

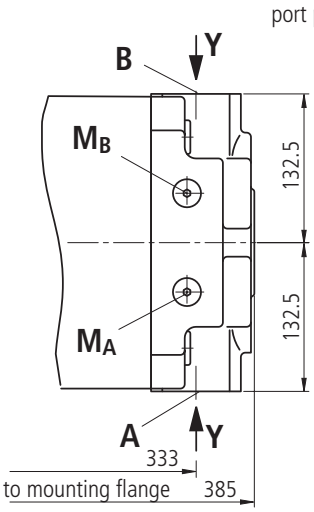


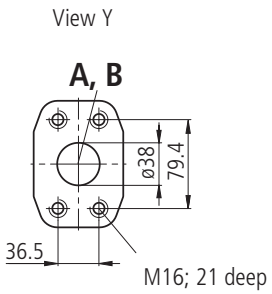
Unit Dimensions, Size 250

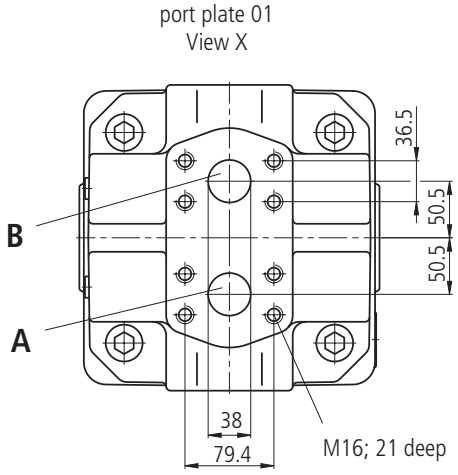
Before finalising your design, please request a certified drawing.











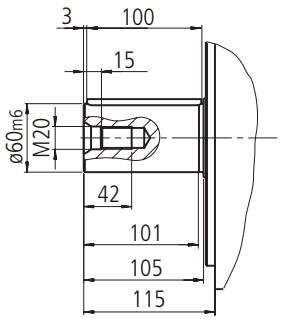
Connections

A, B	service line ports	SAE 1 $^1/_2$" (high pressure series)
R (L)	oil filling and bleed	M42x2
T	oil drain (plugged)	M42x2
M_A, M_B	measuring port for pressure (plugged)	M14x1,5
U	Flushing port, flushing of the bearings (plugged)	M14x1,5

Shaft end

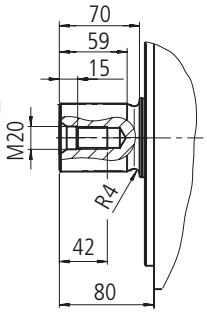
P

Parallel shaft with key
AS 18x11x100
DIN 6885



Z

Splined shaft
W60x2x30x28x9g
DIN 5480



Bosch Rexroth AG
Mobile Hydraulics
Product Segment Axial Piston Units
Elchingen Plant
Glockeraustrasse 2
89275 Elchingen, Germany
Telephone +49 (0) 73 08 82-0
Facsimile +49 (0) 73 08 72 74
info.brm-ak@boschrexroth.de
www.boschrexroth.com/brm

Horb Plant
An den Kelterwiesen 14
72160 Horb, Germany
Telephone +49 (0) 74 51 92-0
Facsimile +49 (0) 74 51 82 21